

What Is Claimed Is:

1. A printing system for use in a high velocity document processing system using lower velocity print technology, the system comprising:

a transport path comprising an upstream transport conveying documents at a transport velocity, a downstream transport conveying documents at the transport velocity, a print transport located between the upstream transport and the downstream transport, the print transport driven independently of the upstream transport and the downstream transports and comprising a plurality of individually controllable rollers;

an upstream print head contiguous with the print transport to print on documents transported thereon;

a downstream print head, downstream of the upstream print head, and contiguous with the print transport to print on documents transported thereon;

a controller controlling a first one of the upstream or downstream print heads to print on transported documents, the controller further switching to a second of the upstream or downstream print heads when the first one is out of service, the controller further controlling a roller group of less than all of the plurality of individually controllable rollers according to a predetermined motion profile, whereby under nominal conditions the roller group decelerates the print transport to a nominal print velocity prior to a printing operation in a first segment,

maintains the nominal print velocity during the printing operation in a second segment, and accelerates the print transport back to the transport velocity after completion of the printing operation in a third segment; and

wherein the controller controls the roller group to comprise of an upstream portion of the plurality of individually controllable rollers if the upstream print head is in use, and to comprise a downstream portion of the plurality of individually controllable rollers if the downstream print head is in use.

2. The printing system of claim 1 wherein one or more of the individually controlled rollers that are not part of the roller group when a given print head is in use are operated at the transport velocity.

3. The printing system of claim 1 wherein the roller group controlled by the controller to decelerates to a stop upon the occurrence of a stoppage condition in the document processing system, the deceleration controlled by the controller in accordance with a predetermined algorithm to maintain a relative displacement of the roller group with respect to upstream or downstream transports to maintain the relative displacements that would have occurred under the predetermined motion profile under nominal conditions, the predetermined algorithm determining the displacement of the roller group as a function of displacement of upstream or downstream transports.

4. The printing system in accordance with claim 3 wherein the controller further controls the roller group to accelerate from a stop back to nominal condition upon the occurrence of a restart after the stoppage condition, the acceleration controlled by the controller in accordance with the predetermined algorithm to maintain the relative displacement of the roller group with respect to upstream or downstream transports to maintain the relative displacements that would have occurred under the predetermined motion profile under nominal conditions, the predetermined algorithm determining the displacement of the roller group as a function of displacement of upstream or downstream transports.

5. The printing system of claim 4 wherein the print heads are electronically or mechanically geared to the corresponding roller group so that variations in print transport velocity during a printing operation will not affect an image being printed.

6. The printing system of claim 4 wherein the predetermined algorithm for determining relative displacements includes a first function for accounting for changes in relative displacements that would have occurred during deceleration of the roller group in the first segment of the motion profile, a second function for accounting for changes in relative displacements that would have occurred during the reduced nominal print velocity of the second segment of the motion profile, and

a third function for accounting for changes in relative displacements that would have occurred during acceleration of the print transport in the third segment of the motion profile, the appropriate of the first, second, and third functions being invoked by the controller based on the position of a document in the roller group during the occurrence of the stoppage condition.

7. The printing system of claim 1 further comprising:

a sensor arrangement comprising an upstream sensor determining a presence of a document within the print transport portion of the transport path and generating a sensor signal;

the controller receiving the signal from the sensor and initiating the predetermined motion profile responsive to the signal.

8. The printing system of claim 1 wherein the upstream portion and the downstream portion of the plurality of individually controllable rollers include at least one same roller and at least one different roller.

9. The printing system of claim 8 wherein the plurality of individually controllable rollers comprises four rollers, and the upstream portion for forming the roller group comprises the three most upstream rollers, and the downstream portion for forming the roller group comprises the three most downstream rollers.

10. The printing system of claim 1 wherein the controller further controls an arrangement of the roller group whereby a member of the roller group leaves the roller group after an envelope passes downstream from the member's control.

11. The printing system of claim 10 wherein the controller controls a velocity of the member that leaves the roller group after the envelope passes downstream from the member's control to be the transport velocity.

12. The printing system of claim 1 wherein the upstream and downstream print heads are comprised of drop-on-demand print heads.

13. A method for printing in a high velocity document processing system using lower velocity print technology, the method comprising:

- transporting a document at a transport velocity in an upstream transport to a print transport;

- transporting the document on the print transport;

- transporting the document at the transport velocity in a downstream transport from the print transport;

- printing an image on the document transported on the print transport using one of an upstream print head or a downstream print head, the downstream print head positioned downstream of the upstream print head;

selecting one of the upstream or downstream print heads for use in printing based which one of the print heads not being available due to print head maintenance;

while the document is within the print transport during nominal system conditions, controlling the velocity of the print transport in accordance with a motion profile, whereby the motion profile includes the steps of decelerating the document to a print velocity, maintaining the print velocity during the step of printing, and accelerating the document to the transport velocity after the step of printing is complete, the motion profile resulting in a relative displacement of the document with respect to upstream and downstream documents to vary during the motion profile;

periodically removing the upstream or downstream print head from use for print head maintenance; and

performing the print transport motion profile with an upstream portion of the print transport when the upstream print head is in use, and with a downstream portion of the print transport when the downstream print head is in use, the upstream and downstream portions each comprising at least one different transport mechanism from the other.

14. The method of claim 13, wherein upon the occurrence of a stoppage condition while the document is within the print transport, further including the steps of:

modifying the motion profile by stopping the document within the print transport during a stoppage condition,

decelerating the document to a stop, the step of decelerating to the stop including the step of maintaining the relative displacement of the document on the print transport with respect to upstream and downstream documents, the step of maintaining the relative displacement including controlling the deceleration according to a predetermined algorithm describing relative displacement between documents as such displacement would have occurred under the motion profile under nominal conditions, the predetermined algorithm determining the displacement of the print transport as a function of displacement of upstream or downstream transports.

15. The printing method in accordance with claim 14 further comprising the steps of:

restarting the print transport while the document is within the print transport during the stoppage condition, the step of restarting including the step of accelerating the document from the stop to a velocity of the motion profile, the step of accelerating including the step of maintaining the relative displacement of the document on the print transport with respect to upstream and downstream documents, the step of maintaining the relative displacement including controlling the acceleration according to the predetermined algorithm.

16. The printing method of claim 15 including the step of electronically or mechanically gearing the printing step to the print transport motion so that variations in print transport velocity during the printing step will not affect the image being printed.

17. The printing method claim 15 wherein the predetermined algorithm for determining relative displacements including a first function accounting for changes in relative displacements that would have occurred during deceleration of the print transport in the first segment of the motion profile, a second function accounting for changes in relative displacements that would have occurred during the reduced nominal print velocity of the second segment of the motion profile, and a third function accounting for changes in relative displacements that would have occurred during acceleration of the print transport in the third segment of the motion profile, and

the method further including the step of invoking the appropriate of the first, second, and third functions based on the position of the document in the print transport during the occurrence of the stoppage condition.



18. The printing method of claim 13 wherein upstream and downstream portions of the print transport are comprised of a grouping of individually controllable rollers, the method further comprising:

controlling the grouping of rollers whereby a member of the grouping leaves the grouping after an envelope passes downstream from the member's control, regardless of the motion profile.

19. The printing method of claim 18 further comprising controlling a velocity of the member that leaves the grouping to be the transport velocity.

20. The printing method of claim 13 further comprising using drop-on-demand ink jet printing for the upstream and downstream print heads.